

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2005/000387

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7): H04J 11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(7): H04J 11/00 in combination with keywords

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Canadian Patent Database, USPTO, Questel-Orbit QPAT, Delphion, IEEE-online, Google

Keywords: ofdm, mimo, pilot, pilot design, scattered pilot, pilot pattern

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20030072254 A1 (MA et al.) 17 April, 2003 (2003-04-17) abstract page 1, paragraph [0008]; page 2, paragraphs [0017], [0020], [0023]; page 3, paragraphs [0030], [0031], [0032], [0035], [0045]; page 4, paragraphs [0060], [0063], [0064]; page 5, paragraphs [0072], [0075]; page 6, paragraphs [0075], [0076]; figures 2, 4, 5, 6	1, 2, 4 - 8, 10 - 13, 15 - 17, 21 - 25, 30 - 34, 36 - 40, 43, 44, 46 - 48
Y	US20030072255 A1 (MA et al.) 17 April, 2003 (2003-04-17) page 1, paragraphs [0005], [0014]; page 2, paragraphs [0017], [0018], [0019], [0026], [0028]; page 3, paragraph [0034]; page 5, paragraphs [0090], [0106]; page 6, paragraphs [0114], [0117]; page 7, paragraphs [0117], [0120], [0124]; figures 1B, 2A, 3, 5, 6	1, 2, 6, 10, 11, 15, 26, 27, 29, 30 - 34, 44

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

15 May 2005 (15-05-2005)

Date of mailing of the international search report

05 July 2005 (05-07-2005)

Name and mailing address of the ISA/CA
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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons :

1. ☐ Claim Nos. :
because they relate to subject matter not required to be searched by this Authority, namely :

2. ☐ Claim Nos. :
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically :

3. ☐ Claim Nos. :
because they are dependant claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows :

Claims 1 - 44, 46 - 48 refer to: a) methods of transmitting over four transmit antennas comprising for each antenna, generating a respective sequence of OFDM symbols, each OFDM symbol having a plurality of sub-carriers carrying at data or pilots, and transmitting the sequence of OFDM symbols, wherein pilots are inserted for the four antennas collectively; and b) apparatuses comprising four antennas and implementing one of the above methods.

Claim 45 refers to a method of transmitting a pair of identical OFDM symbols comprising: transmitting a prefix; transmitting a first OFDM symbol having first and second portions in time, the second portion being identical to the prefix; and transmitting a second OFDM symbol identical to the first OFDM symbol.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos. :
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos. : 1 - 44, 46 - 48

- Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US20040001429 A1 (MA et al.) 1 January, 2004 (2004-01-01) paragraphs [0014], [0017], [0041], [0122], [0130], [0132], [0140], [0141], [0248]	1, 2, 6 - 8, 11 - 13, 15, 17, 29, 37, 38, 40, 43, 44, 46, 47
A	US20030072395 A1 (JIA et al.) 17 April, 2003 (2003-04-17) paragraphs [0012], [0013], [0014], [0015], [0030], [0031], [0077], [0085], [0093], [0097], [0100], [0103]	1, 2, 6 - 8, 11 - 13, 15, 17, 21, 26, 27, 29, 37, 38, 40, 43, 44, 46, 47
L, X, P	TONG et al.: "Enhancing MIMO features for OFDMA PHY layer" IEEE 802.16d-04/65, 2004-04-15 also available at http://www.ieee802.org/16/tgd/contrib/C80216d-04_65.pdf retrieved May 10, 2005 pages 2 - 4	1, 2, 4, 5 - 8, 10 - 13, 15 - 18, 20, 21, 24, 25, 26, 27, 29 - 32, 37, 38, 40, 43, 44, 46 - 48
L, A, P	Qinghua et al.: "Corrected pilot allocation for 4 BS transmit antennas" IEEE C802.16e-04/531r2, 2004-11-12 also available at http://www.ieee802.org/16/tge/contrib/C80216e-04_531r2.pdf retrieved May 10, 2005 all document	1, 2, 4, 6 - 8, 11 - 13, 15, 16, 18, 24, 25, 29, 38, 43, 44, 46, 47
L, A	SIEW et al.: "A Channel Estimation Method for MIMO-OFDM Systems" 25 July 2002, University of Bristol, UK also available at http://citeseer.ist.psu.edu/cache/papers/cs/26591/http:zSzzSzwww.ee.ucl.ac.uk:zSzlcszSzpapers2002zSz.zSzlCS087.pdf/a-channel-estimation-method.pdf retrieved May 10, 2005 sections 1 - 4, 6; figure 1, table 1	1, 2, 6 - 8, 11 - 13, 15, 16, 18, 24, 30 - 32, 43, 44, 46

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Information on patent family members

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Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US2003072254	17-04-2003	EP1442549 A1 US2003072254 A1 WO03034644 A1	04-08-2004 17-04-2003 24-04-2003
US2003072255	17-04-2003	EP1438799 A2 JP2005506757T T US2003072255 A1 WO03034642 A2	21-07-2004 03-03-2005 17-04-2003 24-04-2003
US2004001429	01-01-2004	AU2003232555 A1 EP1520385 A1 US2004001429 A1 WO2004004269 A1	19-01-2004 06-04-2005 01-01-2004 08-01-2004
US2003072395	17-04-2003	EP1438800 A2 US2003072395 A1 WO03034646 A2	21-07-2004 17-04-2003 24-04-2003